APPLICATION

FOR

UNITED STATES LETTERS PATENT

TITLE: LOCAL CACHING OF IMAGES FOR ON-LINE
            CONFERENCING PROGRAMS

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LOCAL CACHING OF IMAGES FOR
ON-LINE CONFERENCING PROGRAMS

Background

This invention relates to multiparty communications

5   over computer networks.

In on-line meeting software, a presenter can
distribute various images via a communications network to
other meeting participants such that each participant is

10   simultaneously viewing the same image on his or her
computer. By way of example, the image may be a slide
created by presentation graphics software. Meeting
participants may then discuss a commonly displayed image
by, for example, on-screen text messaging or "chat"

15   windows, video phones or conventional telephone conference
calling.

With conventional systems, if the meeting participants
wish to return to a previously sent slide for further

20   discussion, the image must be resent from the meeting
presenter's computer to each participant's computer. This
is a time-consuming process inasmuch as images typically
comprise large amounts of data and the data must be sent
over communications channels having finite bandwidths.

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Thus, there is a need for a way to facilitate on-line
conferences.

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Brief Description of the Drawings

Figure 1 shows networked, processor-based systems comprising one embodiment of the present invention;

Figure 2 is a software flow chart for one embodiment of the invention;

Figure 3 is a flow chart for another embodiment of the invention; and

Figure 4 is a flow chart for another embodiment of the invention.

Figure 5 is a flow chart for another embodiment of the invention.

Detailed Description

A network 32 includes at least two client processor-based systems 8, as shown in Figure 1. The network 32 may be a wired or wireless local area network (LAN) in one embodiment of the present invention. Each system 8 may include a processor 38 coupled to a display 34 and a storage device 42. The processor-based system 8a may be used by the presenter in an on-line meeting or conference set up between a presenter and one or more participants. The system 8b may be used by a participant.

Both systems 8 may be personal computers in one embodiment and the storage 42 may be, for example, a magnetic media disk drive with associated disk controllers or solid-state memory such as random access memory (RAM). The system 8b storage 42 may store software 40 for enabling the processor 38 to participate in a network presentation as well as the data 30 to be presented. The system 8a

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storage 42 may store software 50 for implementing a network
presentation.

The software 40 may operate as part of or work with
5   on-line conferencing software. An example of on-line
conferencing software is NetMeeting software from Microsoft
Corporation, Redmond, Washington.

An on-line meeting may be set up between a presenter
10   system 8a and one or more participant systems 8b by
establishing communications over a network 32, as indicated
at block 10 of Figure 2. The presenter's system 8a may
send data to each of the participant systems 8b. The
shared data may be, for example, a series of images or
15   frames. The presenter's system 8a may send each image when
the presenter desires to change the image displayed for
viewing by the participants.

The presenter may have created the images with
20   presentation graphics software and the images may comprise
slides. Each slide may have a unique identifier that may
be, for example, a file attribute of the data comprising
the image.

25   During the course of the on-line meeting, the
presenter's system 8a may send data relating to a slide to
participant systems 8b, as indicated at block 14. As shown
at diamond 18, a participant's system 8b may determine, for
example by testing the slide identifier, whether the slide
30   being sent by the presenter's system 8a is a new slide or a
previously-sent slide. Multitasking techniques may be
employed by a participant's system 8a to compare the

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identifier with the identifiers of cached images while the session is still in progress.

If the slide is a previously-sent slide, it may be available in a local cache of slides and may be retrieved from the cache, as indicated at block 22. The cached slide may be displayed, as indicated at block 26, on the participant's processor-based system 8b.

If the slide is in the local cache, the transmitted image data may be directed to a "bit bucket" while the cached slide is retrieved and displayed as indicated at blocks 22 and 26, respectively. A bit bucket is an imaging location into which data can be discarded.

If, however, the slide is not in the cache, the slide may be downloaded from the presenter's system 8a over the network 32, as indicated at block 20, and subsequently cached and displayed, as indicated at blocks 24 and 26, respectively. In this way, participants who join the meeting late may download a slide previously sent to other participants without delaying the image viewing by the earlier-joining participants whose systems may have the slide in their local caches.

Inasmuch as data can typically be retrieved from a local cache more quickly than it can be downloaded via a network 32, participants in an on-line meeting can save time whenever the presenter returns to a previously-sent slide for discussion that is already available in a participant's system 8b.

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If the meeting is concluded, as indicated at the right branch of diamond 28, the participant system 8b may disconnect from the session as indicated at block 30. The meeting may be over when an indicating signal is sent from the system 8a to the system 8b in one embodiment. If the meeting is not over, as indicated by the lower branch of diamond 28, the participant's system 8b may query the presenter to determine whether the presenter has changed his or her system to edit mode, as indicated at diamond 12.

Graphics generating programs may have multiple modes of operation. For example, a software package for presentation graphics may have an editing mode wherein slides are created and modified and a presentation mode or "slide show" mode wherein a predetermined sequence of slides is displayed seriatim.

The presenter may desire to edit the presentation graphics during the course of an on-line meeting. In such a situation, the presenter may change the state of the system 8a from a presentation mode to an editing mode. If the presenter alters one or more images on his or her system, one or more images which may have been cached by the participants' systems may no longer correspond to the images stored by the presenter's system 8a even though the images may have the same identifier. In such an instance, a participant system 8b local cache is "stale" and should be "flushed", as indicated at block 19 – i.e., cleared from the data storage sub-system of a participant's system as though no images were cached.

The presenter's system 8a may broadcast a message or
code that indicates to all participant systems 8b that the
presenter has switched his or her system to editing mode.
In response, each participant's system 8b local cache may
5   be flushed, as indicated at block 19. Alternatively, each
participant system 8b may query the presenter's system 8a
regarding its mode, as indicated at diamond 12. If the
presenter's system 8a responds that it is in edit mode, the
participant's system 8b may flush its local cache, as
10   indicated at block 19. In yet another alternative, the
presenter's system 8a may indicate which image or images
have been altered and, in response, the participant's
system 8b may flush only those images from its local cache.

15   In this way, a meeting participant's system 8b may
build a local cache of slides during the course of an on-
line meeting as the meeting presenter's system 8a sends
individual slides, seriatim. During a meeting, because a
participant's system 8b is able to retrieve previously-sent
20   slides from a local cache, the images may be displayed more
quickly than if the image data is again downloaded from a
network 32.

In another embodiment, an on-line meeting presenter's
25   system may send a slide identifier (but initially not image
data) to meeting participant system 8b, as indicated at
block 15 of Figure 3. The presenter system 8a may then wait
for a request from a participant system 8b for the image
data comprising the slide.
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As indicated at block 17 of Figure 3, a meeting
participant system 8b may determine from the slide

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identifier whether the slide exists in its local cache. If the slide is found in the local cache, it may be retrieved from the cache 22 and displayed, as indicated at blocks 22 and 26, respectively.

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If, however, the image data comprising the slide is not found in the local cache, as indicated at the right branch of diamond 17, the participant system 8b may request the slide from the presenter system 8a, as indicated at

10   block 21. The presenter system 8a may, in response, send the requested slide, as indicated at block 16, which data may then be stored by the participant system 8b in its local cache and displayed, as indicated at blocks 24 and 26, respectively.

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In this embodiment, the presenter system 8a need not send the image data comprising the slide if all participant systems 8b already have the slide in their local caches - i.e., if no participant system 8b requests a download of

20   the image data. In this way, both time and network resources may be conserved.

In yet another embodiment, cache-participants may receive a download of a slide during the course of an on-

25   line meeting and subsequently determine whether a cached version differs from the downloaded version. In the meantime, the cached version may be displayed. The presenter's system 8a may send data relating to a slide to participant systems 8b, as indicated at block 14 of Figure

30   5. A participant's system 8b may extract a slide identifier from this data as shown at block 15a. As shown at diamond 17, a participant's system 8b may then

determine, for example by testing the slide identifier, whether the slide being sent by the presenter's system 8a has the same identifier as a previously-sent slide. Multitasking techniques may be employed by a participant's

5   system 8a to compare the identifier with the identifiers of cached images while the session is still in progress.

If the slide identifier corresponds with that of a previously-sent slide, it may be available in a local cache

10   of slides and may be retrieved from the cache, as indicated at block 22. The cached slide may be displayed, as indicated at block 26a, on the participant's processor-based system 8b along with a warning to the viewer that the slide may not correspond with that of the presenter's

15   system.

As indicated at block 20, the download of image data may be completed by the participant's system. As indicated at diamond 23, the just-downloaded image data may then be

20   compared to the cached image data having the same slide identifier to determine whether there has been any change in the data. If no change is detected, the warning on the display may be removed as indicated at block 26c. If, however, a change is found, the just-downloaded data may be

25   stored in the cache replacing the previously stored data having the same identifier, as indicated at block 24a. The displayed image may then be updated using the new data and the display warning removed as indicated at blocks 26b and 26c, respectively. If the changes in the image data are

30   minimal, display techniques may be employed to smoothly "morph" the image from the previous version to the more recent one.

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If, however, the slide is not in the cache as
indicated by the left branch of diamond 17, the slide may
be downloaded from the presenter's system 8a over the
5   network 32, as indicated at block 20a, and subsequently
cached and displayed, as indicated at blocks 24 and 26,
respectively.

In this way, the speed of a cache-based system may be
10   realized whenever the meeting participants return to a
previously sent slide even if the image must subsequently
be modified due to a change in the image by the presenter.

Referring to Figure 4, the software 50 on the
15   presenter system 8a may implement the caching protocol in
conjunction with the participant systems 8b. Initially,
the presenter system 8a establishes the network meeting as
indicated in block 52. Information may be sent to the
participants concerning each slide as indicated in block
20   54. In some embodiments, this may include the initial
download of a portion of the slide. In other embodiments,
only an identifier for the slide may be provided. If only
an identifier is provided, then the information is not sent
until the participant indicates that it actually wants the
25   download. If only a portion of the slide is provided, the
same protocol may be utilized or, the information may be
transmitted even if the participant determines that it will
not receive the information.

30   If the download is requested as determined in diamond
56, the data may be sent as indicated in diamond 58.

In another embodiment, the network 32 may be the Internet. In such case, the systems 8 may communicate and send slides or other data over the Internet.

5   While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall
10   within the true spirit and scope of this present invention.